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AVAILABLE SUPPLY OF ARSENIC

LETTER

FROM

THE SECRETARY OF AGRICULTURE

TRANSMITTING

IN RESPONSE TO A SENATE RESOLUTION OF
DECEMBER 6, 1922, INFORMATION RELATIVE
TO THE AVAILABLE SUPPLY OF ARSENIC
TO MEET THE DEMAND IN 1923



JANUARY 16 (calendar day, JANUARY 18), 1923.—Referred to the
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LETTER OF TRANSMITTAL.

DEPARTMENT OF AGRICULTURE,
Washington, January 17, 1923.

Hon. CALVIN COOLIDGE,
President of the Senate.

DEAR MR. PRESIDENT: In response to Senate Resolution No. 377, copy of which was duly received by the department, I am transmitting herewith a joint report on the available supply of arsenic to meet the demand in 1923, by Mr. B. R. Coad, of the Bureau of Entomology of this department, and Mr. G. F. Loughlin, of the United States Geological Survey of the Interior Department. There is also inclosed a letter from the Secretary of the Interior transmitting the report to this department.

Very truly yours,

HENRY C. WALLACE,
Secretary.

LETTERS OF SUBMITTAL.

DEPARTMENT OF THE INTERIOR,
Washington, January 15, 1923.

The SECRETARY OF AGRICULTURE.

SIR: Senate Resolution No. 377 provides that—

Whereas there is an emergency confronting the agricultural interests of the country in view of the difficulty in obtaining arsenical insecticides for alleviating the ravages of insect pests and especially the great need for calcium arsenate for the control of the boll weevil: Therefore be it

Resolved, That the Secretary of Agriculture, through the Bureau of Entomology, in cooperation with the Department of the Interior, through the United States Geological Survey, is hereby authorized and directed to investigate the supply of white arsenic in the United States and the possible development of additional sources of supply and to report the same to Congress at the earliest possible time.

I transmit herewith a copy of a letter from the Acting Director of the Geological Survey submitting, pursuant to the resolution above mentioned, a joint report on the available supply of arsenic to meet the demand in 1923, by Hon. B. R. Coad, of the Bureau of Entomology, Department of Agriculture, and G. F. Loughlin, of the United States Geological Survey, with a view to its consideration and transmission to Congress.

Respectfully,

ALBERT B. FALL, *Secretary.*

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, January 12, 1923.

The SECRETARY OF THE INTERIOR.

SIR: I transmit herewith a joint report on the available supply of arsenic to meet the demand in 1923, by B. R. Coad, of the Bureau of Entomology, Department of Agriculture, and G. F. Loughlin, of the United States Geological Survey.

This report was prepared in accordance with Senate Resolution No. 377, and it is requested that after approval you forward it to the Secretary of Agriculture for transmittal to Congress.

Respectfully,

M. R. CAMPBELL,
Acting Director.

REPORT ON AVAILABLE SUPPLY OF ARSENIC TO SUPPLY THE DEMAND IN 1923.

entomology
(By B. R. COAD, Bureau of Entomology, Department of Agriculture, and G. F. LOUGHLIN, United States Geological Survey, Department of the Interior.)

SUMMARY.

Increase in demand for calcium arsenate is mainly responsible for the present shortage of white arsenic. Domestic production in 1922 was greater than in any preceding year except 1920, but took place mostly in the last third of the year, when there remained insufficient time to satisfy the urgent demand for calcium arsenate, which extends to May or June, 1923. Imports have been very low during 1922 and not much improvement is to be expected during the first part of 1923.

Minimum annual requirements of white arsenic amount to about 12,000 short tons, more than three-fourths of which are needed during the first four months. Domestic producers can supply this quantity, but not fast enough to meet the early requirements of 1923. Every effort is being made by producers and manufacturers to meet these requirements, and considerable arsenic that would ordinarily be used for other compounds is to be diverted to calcium arsenate. Both domestic and imported white arsenic is already largely sold up to April, 1923, and the average price for the advance domestic sales is about 9 cents a pound. The very recent rapid advances in price have evidently been due to manipulation of small lots of imported arsenic, too small to affect seriously the total quantity of arsenic available. Rumors that large stocks of white arsenic are being held by speculators are unfounded.

Production will no doubt be adequate to meet the requirements of 1924 and subsequent years, if the market is sufficiently stable to encourage producers. A standing committee representing producers, manufacturers, and interested bureaus of the Federal Government has been appointed to study ways and means of stabilizing the market.

In view of the increasing industrial importance of arsenic, it is proposed that a comprehensive cooperative study be made by appropriate Government bureaus of the occurrence, reserves, production, and utilization of arsenic.

Introduction.—The following report has been prepared in accordance with a resolution passed by Congress recently, authorizing and directing the Bureau of Entomology, Department of Agriculture, and the United States Geological Survey, Department of the Interior, to investigate the available supplies of arsenic in the United States, Mr. B. R. Coad, of the first-named bureau, and Mr. G. F.

Loughlin, of the second, were assigned to this investigation. Previous to this assignment Mr. Coad had been investigating the question, and Mr. V. C. Heikes, the United States Geological Survey's specialist on arsenic, with headquarters in Salt Lake City, Utah, had been gathering data for his annual statistical report on the production of arsenic in 1922. This advance preparation, together with results of a conference of producers of white arsenic and manufacturers of arsenic compounds held in New York, December 13, 1922, and attended by Messrs. Coad and Loughlin, render it possible to present the report at this time. An exhaustive study of supplies, production, and utilization of arsenic would require a much longer time; but as the present critical state of the arsenic industry is due to the demand for calcium arsenate from now until May or June, 1923, when demand may slacken for a time, such an exhaustive study could not relieve the present situation.

Causes of the present condition of the arsenic market.—The use of calcium arsenate as an insecticide for the cotton-boll weevil began in 1919. Manufacturers in 1920 laid in supplies of refined white arsenic in anticipation of a large demand for calcium arsenate in 1921. They planned to sell their product on a basis of cotton at 45 cents a pound, but the price of cotton later dropped to 12 cents a pound and left the cotton growers unable to purchase. Manufacturers were therefore left with large stocks of calcium arsenate well into 1922. One manufacturer in an effort to reduce his stocks contracted to supply the State of Georgia with a large quantity of calcium arsenate at 9 cents a pound. This price, lower than the cost of manufacture, discouraged other manufacturers from preparing to meet any demand for 1922. Southern banks, however, liberally financed the purchase of calcium arsenate in 1922, and although there were about 8,000,000 pounds of calcium arsenate in warehouses early in the year, this supply was soon exhausted. Manufacturers became oversold and found themselves with no white arsenic on hand. With the demand now acute, manufacturers rushed into the market for white arsenic and manufactured as much calcium arsenate as they could through the remainder of the season. Altogether about 16,000,000 pounds (8,000 tons) of calcium arsenate (equivalent to about 3,600 tons of white arsenic) was sold and did not satisfy the demand.

This change of conditions is reflected in the price of refined white arsenic in 1922. Until the early fall it was not high enough to encourage production. It then began to increase, but not fast enough to stimulate production to the maximum until December. As prices steadily rose and buyers experienced difficulty in obtaining supplies, the Department of Commerce began to receive inquiries as to the cause of the shortage and decided to call the conference, already mentioned, of producers, manufacturers, and interested bureaus of the Federal Government at Hotel Astor, New York City, December 13, 1922. Mr. C. R. De Long, representing the Department of Commerce, presided at this meeting. Information gathered at this conference confirmed that already obtained by Messrs. Coad and Heikes.

Production and imports of arsenic.—The production of white arsenic and imports of white arsenic and other arsenic compounds during the last 10 years are given in the following table:

White arsenic (As_2O_3) produced in the United States, 1913 to 1922, inclusive, in short tons.

Year.	Quantity.		Value.	Imports.							
				White arsenic.		Arsenic, sulphide of, or orpiment.		Paris green and London purple.		Sheep dip.	
	Re-fined.	Crude.		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1913....	2,513	.....	\$159,236	1,519	\$133,597	3,182	\$276,849	50	\$4,431	.....	\$40,036
1914....	4,470	200	313,147	1,594	109,121	2,034	164,592	8	2,235	.....	34,556
1915....	5,145	353	302,116	1,400	113,677	1,783	154,099	11	4,069	.....	19,916
1916....	5,834	152	555,187	1,071	107,876	1,092	124,818	12	5,028	.....	20,134
1917....	6,151	.....	1,118,313	1,178	264,534	2,777	410,341	³ 48	189	.....	15,846
1918....	6,323	.....	1,213,000	1,847	441,212	4,842	840,600	.....	.....	.....	23,538
1919....	6,029	.....	1,181,684	4,389	624,494	2,151	316,687	³ 18	14	73	12,346
1920....	10,906	596	2,021,356	3,740	532,635	4,080	684,016	³ 772	227	35	5,150
1921....	3,427	1,359	717,700	1,669	253,250	3,343	531,322	³ 325	123	31	6,362
1922....	9,581	1,366	¹ 1,486,000	² 210	² 30,926	² 3,292	² 403,006	² 31,662	² 288	² 9	² 1,670

¹ Refined arsenic only

² First three quarters of 1922.

³ Pounds.

No domestic white arsenic is exported. Some foreign arsenic and arsenic sulphide is reexported, but has no effect on the present problem.

The steady increase in production, beginning with 1914, in part offset a decline in imports and in part was evidently due to a generally increased demand during the war. In 1917 intensive gardening caused an unusual demand for insecticides and a shortage of arsenic developed, which caused the Food Administration to fix the producers' price at 9 cents a pound for carload lots until the close of 1918. In December, 1917, manufacturers of insecticides estimated their needs for the growing season of 1918 at 6,900 short tons. Manufacturers of sheep dip called for 1,000 tons, whereas glass manufacturers ordinarily called for about 2,000 tons. Production and imports of white arsenic in 1918 did not equal this estimated demand; but as glass manufacturers consumed only 500 short tons, stocks at the end of the year amounted to 449 short tons, or 7 per cent of domestic production, and domestic production declined somewhat in the dull year of 1919, but imports of white arsenic more than doubled. The large increase in production in 1920 and the slump in 1921 were due to the expected demand for calcium arsenate and the collapse of the cotton market as already explained. The recovery in production in 1922 is due largely to activity in the last third of the year after manufacturers' stocks of calcium arsenate had become exhausted.

The decline in imports of white arsenic in 1921 was in similar proportion to that of domestic production. During the first three quarters of 1922 imports have been negligible, and conditions in the principal foreign producing countries appear to be such that no marked increase in imports can be expected during the last quarter of 1922 or perhaps even in the first quarter of 1923.

In contrast to the imports of white arsenic, those of arsenic sulphide were nearly the same in 1922 as in 1921 and only 18 per cent lower than in 1920; but arsenic sulphide or orpiment is used principally as a pigment and dye, also in the manufacture of fireworks and in some depilatories, and is not related to the white-arsenic problem. Imports of Paris green or London purple and of sheep

dip are negligible compared with the domestic requirements shown on a later page.

Present demand and supply.—The present demand for white arsenic is stated by Mr. Heikes to be about 12,000 short tons a year and the capacity of white-arsenic refineries in the United States to be 18,000 tons a year. It was estimated by Mr. F. L. Hess, of the United States Geological Survey, in 1916, that 14,000 or 15,000 short tons of arsenic trioxide (crude white arsenic) were liberated each year in the treatment of arsenical copper ores of the Butte (Mont.) district, and that at least 25,000 tons of white arsenic could be saved each year as a by-product from the smelting of the arsenical ores mined in the Western States. There is no fear, therefore, that the quantity of by-product arsenic released by the smelting of arsenical ores can more than supply the capacity of the refineries. In addition to this supply, there are deposits which are being or may be worked primarily for their arsenic content, but information concerning them is too meager to permit an estimate of their reserves.

The minimum demand, based on investigations by Mr. Coad, may be itemized as follows:

Requirements of white arsenic by manufacturers of arsenic compounds, in short tons.

	Annual.	To May 1, 1923.
In manufacture of—		
Lead arsenate.....	2,000	2,000
Paris green.....	1,200	1,200
Proprietary mixtures.....	750	250
Weed killers.....	1,500	1,500
Dips.....	1,000	350
Glass.....	2,000	670
Calcium arsenate.....	3,500	3,500
Total.....	11,950	9,470

The minimum annual demand is based on the assumption of a light insecticide year. The requirements of white arsenic for glass manufacture, sheep dip, and miscellaneous may be rather uniformly distributed throughout the year, whereas those for insecticides and weed killer are concentrated in the first third of the year.

There appears to be no question that domestic producers can supply such an annual demand if given sufficient warning, but the present demand for calcium arsenate must be supplied before June, 1923. Mr. Heikes states that stocks of refined white arsenic on hand October 1 were reported to be 1,230 tons, and that about 3,400 tons will be produced between October 1, 1922, and May 1, 1923. Mr. Coad's investigation confirms this estimate. Most of this quantity has already been sold in advance. Imports, also sold as far ahead as April, 1923, are expected to increase the supply by a few hundred tons.

In addition to this supply it is probable that an increase of 40 tons a month in output of crude arsenic by one producer can be used in the manufacture of weed killers, releasing an equivalent amount of refined white arsenic. It is also probable that some white arsenic can be diverted from the manufacture of lead arsenate and glass. One manufacturer expects to make a 60 per cent reduction

in his output of lead arsenate, and several others indicate somewhat smaller reductions.

To this supply should be added any production of calcium arsenate direct from ore at the newly erected plant of the Salt Lake Insecticide Co., Salt Lake City, Utah. The process reported to be in successful operation at Toulon, Nev., for direct recovery of white arsenic from ore may be applicable to a number of arsenic ores that have not been profitably worked heretofore, but the erection of plants to treat these ores could not proceed rapidly enough to have any noteworthy effect upon the present situation. It therefore appears impossible to relieve completely the present shortage, but every means is being taken to relieve it as much as possible.

Prices.—Mr. Coad has had access to the books of the American Smelting & Refining Co. and the United States Smelting, Refining & Mining Co., and verifies the statements of these companies made at the conference on December 13 that practically all of their output has been sold direct to consumers through May, 1923. The average prices at which advance sales have been made by these companies is a little more than 9 cents a pound.

Sales by the United States Smelting, Refining & Mining Co. averaged a little more than 9 cents gross and 8.3 cents net, while those by the American Smelting & Refining Co. averaged 9.63 cents gross, with an estimated average delivery cost of five-eighths cent a pound.

The Anaconda Co. last October had received orders for more white arsenic than it was sure of producing. These companies, the principal domestic producers, are therefore unable to take advantage of the high price (15 to 17 cents) a pound in December, 1922, for any appreciable quantity of white arsenic, and the conclusion is obvious that any recent speculation in white arsenic has been with imported material. Mr. Coad recently traced a lot of 25 tons of foreign arsenic, a composite lot from several countries, through the hands of eight brokers, the price rising with each transfer; but this lot has not reached the hands of consumers. Speculation has therefore had considerable to do with the recent rapid rise in the quoted market price, but the quantity of white arsenic in speculators' hands is too small to have appreciable effect on the quantity available for consumers. The facts that domestic producers are sold three or four months in advance and that very little white arsenic has been imported in 1922 indicate that an actual shortage exists and are a direct contradiction of the rumors that large stocks of white arsenic are being held.

The average prices of spot sales (collected by Mr. Coad) in 1921 and 1922 have been as follows:

	1921	1922		1921	1922
January.....	7½	7-7½	September.....	6	9.13
February.....	(1)	7½	October.....	6	10.1
March.....	7½-8	6.60	November.....	6½-6¾	11¼
April.....	6¾	6.65	December.....	7	.....
May.....	6½-6¾	7	Annual average based on pro-		
June.....	6½-7	7½	ducers' reports to U. S.		
July.....	6.09	7.40	Geological Survey.....	7.498	7.75
August.....	5.81	7¾			

¹ No sales.

Comparison of these spot sales with the average price for the year received by producers shows that the quantity sold at less than 7 cents in 1921 and at more than 9 cents in 1922 must have been small. The average prices reported by producers to the United States Geological Survey have been as follows:

	Average per pound (cents).		Average per pound (cents).
1901-1905.....	2.837	1920.....	8.787
1906-1910.....	3.153	1921.....	7.498
1911-1915.....	2.740	1922.....	7.75
1916-1919.....	8.306		

It is evident that every effort is being made to supply all the domestic white arsenic possible for calcium arsenate by May, 1923. It will be impossible to supply the entire demand of the cotton growers for the 1923 season, but most of the arsenic available has already been purchased at a reasonable price by manufacturers, and the calcium arsenate made by them should be obtainable at an equally reasonable price, although some advance over the lowest prices of 1922 must be expected, as these prices were below the cost of production and were based on distressed merchandise.

Future supplies.—As regards 1924 and subsequent years, demands equal to that of 1923 can be met by domestic producers if the market for arsenic is sufficiently stable to encourage production. Instability has been characteristic of the arsenic market, particularly since 1917. This condition was illustrated at the conference in New York, December 13, by Mr. H. M. Brush, of the American Smelting & Refining Co., who read his company's record of sales during 1921 and 1922. These sales varied from a few hundred tons in one month to 4 or 5 tons the next, a few hundred again in the third, none at all in the fourth, one or two hundred in the fifth, and so on. Sales did not reach 1,000 tons a month until late in 1922. Under such conditions there could be no inducement to produce in quantity, particularly with the price as low as it was from April, 1921, to June, 1922. Under present conditions, according to Mr. Brush, white arsenic at 5 or 6 cents a pound is not worth producing. A steady demand for white arsenic at 8 or 9 cents a pound would assure steady production. Ways and means of stabilizing the market were referred by the New York conference to a standing committee consisting of the following representatives of producers, manufacturers, and interested bureaus of the Federal Government:

B. R. Coad (chairman), Bureau of Entomology, Department of Agriculture.
 G. F. Loughlin, United States Geological Survey, Department of the Interior.
 H. M. Brush, American Smelting & Refining Co.
 F. Y. Robertson, United States Smelting, Refining & Mining Co.
 Frank Hemingway, Sherwin-Williams Co.
 R. N. Chipman, Chipman Chemical Engineering Co.
 O. A. Hasse, The Glidden Co.
 W. O. Tuck, Pittsburgh Plate Glass Co.

This committee met on the afternoon of December 13 at Hotel Astor, New York City, and frankly discussed the question of a stable market, but the suggestions offered only made it clear that stability must depend on the natural law of supply and demand, and that attempts to set aside this law will only tend to promote confusion in the long run. Ability to stabilize the market must depend on ability to foresee well in advance the factors that will influence demand.

Producers, manufacturers, and consumers acting independently have thus far not been successful forecasters, but some improvement may result from concerted action. With this end in view the committee plans to meet in February or March, when manufacture of insecticides for the 1923 season is well advanced, and again in September or October, when plans for the season of 1924 should be laid.

As the use of calcium arsenate as an insecticide has emerged from the experimental stage but is still in its infancy, it may be expected to increase rapidly in the next few years, and there may still be some question as to the quantity of readily available arsenic that can be produced annually over a long period of years. There is little doubt as to the adequacy of the supply of arsenical ores, but heretofore it has generally not been profitable to mine and treat ores for their arsenic content only. In view of this fact and the probable growing annual demand for arsenic it is suggested that a systematic cooperative study be made of the occurrence and supplies of arsenical ores, their reduction, and the manufacture and use of arsenic compounds, such a study to be conducted by the United States Geological Survey and the Bureau of Mines of the Department of the Interior and the Bureaus of Chemistry and Entomology of the Department of Agriculture.



